

## **REMARKS**

Claims 1-34 are pending in the present application. Claims 1-5, 12, 14, 22-25, and 28 were rejected under 35 U.S.C. §102(e). Claims 6-9, 11, 13, 15, 20-21, 26, 27 and 29-31, and 34 were rejected under 35 U.S.C. §103(a). Claims 10, 16-19, 32, and 33 were objected to for depending on a rejected claim, but were indicated to be allowable if rewritten in independent form to including all of the limitations of the base claim and any intervening claims. The Office Action refused to consider certain foreign patents and non-patent references submitted in the Information Disclosure Statements of June 17, 1999 and September 7, 1999.

### **Applicants' Information Disclosure Statements and Compliance With 37 C.F.R. §§1.97 and 1.98 And MPEP §609**

The Office Action refused to consider French Patent No. 1,436,154 (filed on September 7, 1999) because a translation was not provided. The Office Action also refused to consider the foreign patents and non-patent literature in the Information Disclosure Statement filed on June 17, 1999.

French Patent No. 1,436,154 was cited in an international search report in a counterpart international application (International Appl. No. PCT/CA99/00134). The search report

identified French Patent No. 1,436,154 as an "X" reference with respect to claims 1, 2, 4, 12, and 22. The search report was submitted with Applicants' Supplemental Information Disclosure Statement dated June 15, 1999.

Applicants are submitting the International Preliminary Examination Report for International Appl. No. PCT/CA99/00134. The IPER contains the following description of French Patent No. 1,436,154:

FR-A-1436154 discloses DME among a variety of organic substances which are suggested as fuel for fuel cells consisting of an anode and a cathode prepared from an active metal power and Teflon, the electrolyte being phosphoric acid.

Thus, Applicants' understanding is that French Patent No. 1,436,154 discloses a phosphoric acid fuel cell, not a solid polymer electrolyte fuel cell.

Applicants believe the submission of the International Search Report and the International Preliminary Examination Report are sufficient to satisfy Applicants' duties under 37 C.F.R. §§1.97 and 1.98 and MPEP §609.

Where the information listed in not in the English language, but was cited in a search report or other action by a foreign patent office in a counterpart

foreign application, the requirement for a concise explanation of relevance can be satisfied by submitting an English-language version of the search report or action which indicates the degree of relevance found by the foreign office. This may be an explanation of which portion of the reference is particularly relevant, to which claims it applies, or merely and "X", "Y", or "A" indication on a search report.

Manual of Patent Examination Procedure, §609, page 600-122 (8th Ed. 2001).

As discussed in more detail below, Applicants have amended claims 1 and 22 so that they recite a solid polymer electrolyte. Applicants amended claims 1 and 22 in the same fashion in International Appl. No. PCT/CA99/00134 after the receipt of the International Search Report and the first Written Opinion (copies of which are submitted herewith). After Applicants amended claims 1 and 22, those amended claims were determined to be allowable over French Patent No. 1,436,154. (See International Preliminary Examination Report dated March 17, 2000). Thus, Applicants believe that amended claims 1 and 22 (as well as claims depending from them) are patentable over French Patent No. 1,436,154.

Support for the above amendments to independent claim 1 can be found in the written description, for example, at page 6, lines 28-32. Support for the above amendments to independent claim 22 can be found in the written description, for example, at page 12, lines 9-12 and in original claim 22.

**Rejection of Claims 1-9, 11-15, 20-31, and 34**  
**Based on Tillmetz et al. U.S. Patent No. 6,410,175**

Claims 1-5, 12, 14, 22-25, and 28 were rejected under 35 U.S.C. §102(e) as anticipated by Tillmetz et al. U.S. Patent No. 6,410,175. Claims 6-9, 11, 13, 15, 20-21, 26, 27 and 29-31, and 34 were rejected under 35 U.S.C. §103(a) as rendered obvious by Tillmetz in view of Narayanan et al. U.S. Patent No. 6,299,744.

Applicants traverse these rejections on the grounds that Tillmetz is not effective as prior art against the present application. The present application is entitled to a foreign priority date (February 25, 1998) which is earlier than Tillmetz's filing date (November 12, 1998).

The present application claims the benefit of priority from  
German Patent Application No. 19807876.5, which was filed on  
February 25, 1998. The present application was filed on  
February 24, 1999, within one year of the filing of the German

application. The declaration submitted for the present application properly claimed the benefit of the priority date of the German application.

The present application is entitled to the benefit of the filing date of German Patent Application No. 19807876.5 because the German application discloses the use of dimethyl ether as a fuel. More specification, the German application states:

The fuel cell system shown in the figure comprises a fuel cell 10, consisting of an anode chamber 12 and a cathode chamber 14, separated by a proton conducting membrane 16. A liquid coolant/fuel mixture is supplied to the anode chamber 12 by an anode feed line 18. All substances which can be oxidized chemically and have the general structural formula  $H-[CH_2O-]_n-Y$ , with  $1 \leq n \leq 5$  and  $Y=H$  or  $Y=CH_3$ , can be used as fuel.

(Translation of German Application No. 19807876.5, pages 3-4).

The structural formula recited for the fuels describes 10 specific compounds. One of those 10 compounds is dimethyl ether. Dimethyl ether is specified by the structural formula when  $n=1$  and  $Y=CH_3$ .

Since the present application has properly claimed the benefit of the February 25, 1998 filing date of German Application No. 19807876.5 under 35 U.S.C. §119, the rejections

based on Tillmetz et al. U.S. Patent No. 6,410,175 must be withdrawn.

In view of the foregoing amendments and remarks, applicants submit that claims 1-9, 11-15, 20-31, and 34 are allowable, in addition to claims 10, 16-19 and 32-33 indicated as being allowable. The Examiner is invited to telephone the applicants' undersigned attorney at (312) 775-8123 if any unresolved matters remain. A Petition for Two-Month Extension of Time accompanies this Amendment and Request for Reconsideration, along with the requisite fee for extension of time within the second month. Please charge any fees incurred in connection with this submission to Deposit Account No. 13-0017 in the name of McAndrews, Held & Malloy, Ltd.

Respectfully submitted,



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Dated: May 27, 2003

# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

## PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT  
OR DECLARATION

### DOCKETED

To:  
RUSSELL REYNEKE  
Attn. DE KOCK, E.  
Suite 700 - Two Bentall Centre  
555 Burrard Street  
Vancouver, British Columbia V7X 1M8  
CANADA

(PCT Rule 44.1)  
**ARTICLE 19 AMENDMENTS**  
**DUE: SEPTEMBER 14 1999**  
**(MUST FAX BY SEPT. 13/99)**

Date of mailing  
(day/month/year) 14/07/1999

Applicant's or agent's file reference  
142201 (BAL)

**FOR FURTHER ACTION** See paragraphs 1 and 4 below

International application No.  
PCT/CA 99/00134

International filing date  
(day/month/year) 24/02/1999

Applicant

BALLARD POWER SYSTEMS INC. et al.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

**Filing of amendments and statement under Article 19:**

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

**When?** The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

**Where?** Directly to the International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland  
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Maria Van der Hoeven

## NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

### INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

#### What parts of the International application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

#### When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

#### Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

#### How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

#### What documents must/may accompany the amendments?

##### Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.



## NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:  
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:  
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:  
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or  
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:  
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

### "Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

### Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

### Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>142201 (BAL)</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/CA 99/ 00134</b>	International filing date (day/month/year) <b>24/02/1999</b>	(Earliest) Priority Date (day/month/year) <b>25/02/1998</b>
Applicant <b>BALLARD POWER SYSTEMS INC. et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 5 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

## 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

## 4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

## 5. With regard to the abstract,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1  
☐ None of the figures.

# INTERNATIONAL SEARCH REPORT

national application No.

PCT/CA 99/ 00134

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The abstract has to be changed as follows:  
Line 1, after "cells" insert "(10)";  
Line 6, after "solution" insert "(20,21)".

## ERNATIONAL SEARCH REPORT

International Application No

PCT/CA 99/00134

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 H01M8/10 H01M8/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	QINGJUN ZHAO ET AL: "ELECTROCATALYTIC OXIDATION OF METHANOL AND DIMETHYL ETHER ON PLATINUM AT ELEVATED TEMPERATURES IN 85 % H3PO4" EXTENDED ABSTRACTS FALL MEETING MIAMI BEACH, FLORIDA OCTOBER 9-14 1994, vol. 94/2, page 962/963 XP000550928 see page 962, right-hand column, paragraph 3 see page 962, left-hand column, paragraph 1 see page 962, left-hand column, last paragraph	1-3, 22
Y	---	3, 4, 11, 15, 17, 23-25, 28, 30, 34
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

Date of the actual completion of the international search

29 June 1999

Date of mailing of the international search report

14/07/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

D'hondt, J

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>WO 96 12317 A (UNIV SOUTHERN CALIFORNIA ; CALIFORNIA INST OF TECHN (US)) 25 April 1996</p> <p>see claims 1,2,8,17,24; figure 1 see page 16, paragraph 3 see page 21, paragraph 3 - page 23, paragraph 1</p> <p>---</p>	<p>3,4,11, 15,17, 23-25, 28,30,34</p>
X	<p>FR 1 436 154 A (COMPAGNIE FRANCAISE THOMSON-HOUSTON) 1 July 1966 see page 7, left-hand column, line 49 - right-hand column, line 5</p> <p>---</p>	<p>1,2,4, 12,22</p>
E	<p>JP 11 144751 A (NE CHEMCAT CORP) 28 May 1999 see the whole document -&amp; CHEMICAL ABSTRACTS, vol. 130, Columbus, Ohio, US; abstract no. 340654, TSUTSUMI, YASUYUKI ET AL: "Dimethyl ether fuel cells, dimethyl ether fuel cell power plants, method for power generation and electrode catalysts" XP002107543 see abstract &amp; JP 11 144751 A (NE CHEMCAT CORP) 28 May 1999</p> <p>---</p>	<p>1-3,11, 22-24</p>
P,X	<p>CHEMICAL ABSTRACTS, vol. 130, Columbus, Ohio, US; abstract no. 327226, YASUYUKI, TSUTSUMI ET AL: "Feasibility of fuel cell using dimethyl ether fuel" XP002107518 see abstract &amp; ADV. ALCOHOL FUELS WORLD, PROC. INT. SYMP. ALCOHOL FUELS, 12TH (1998), 403-408. EDITOR(S): ZHU, QIMING. PUBLISHER: TSINGHUA UNIVERSITY PRESS, BEIJING, PEOP. REP. CHINA. CODEN: 67PIAK,1998,</p> <p>---</p>	<p>1-3,22, 23</p>
A	<p>US 2 925 454 A (EDUARD JUSTI ET AL) 16 February 1960 see column 4, line 70 - line 75; claims 1,2</p> <p>---</p>	<p>1,2,4,15</p>
A	<p>US 3 227 585 A (DAVID LANGFORD ET AL) 4 January 1966 see column 3, line 42 - line 52; claim 1</p> <p>---</p> <p>-/--</p>	<p>1,2,4,22</p>

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 99/00134

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	<p>CHEMICAL ABSTRACTS, vol. 129, Columbus, Ohio, US; abstract no. 233126, OGAWA, HAKARU ET AL: "Method for operating fuel cells" XP002107520 see abstract -&amp; PATENT ABSTRACTS OF JAPAN vol. 98, no. 14, 31 December 1998 &amp; JP 10 255830 A (TOSHIBA CORP), 25 September 1998 see abstract -&amp; DATABASE WPI Derwent Publications Ltd., London, GB; AN 98-574080 XP002107545 A see abstract</p>	1,7,22
P,A	<p>--- CHEMICAL ABSTRACTS, vol. 129, Columbus, Ohio, US; abstract no. 83788, TOMURA, KEJI ET AL: "Fuel cells using dimethyl ether raw fuel" XP002107544 see abstract &amp; JP 10 189022 A (NIPPON KOKAN CO., LTD., JAPAN) -&amp; PATENT ABSTRACTS OF JAPAN vol. 98, no. 12, 31 October 1998 &amp; JP 10 189022 A (NKK CORP), 21 July 1998 see abstract -----</p>	1

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 99/00134

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9612317 A	25-04-1996	AU 8121994 A BR 9408623 A EP 0755576 A JP 10507572 T	06-05-1996 16-09-1997 29-01-1997 21-07-1998
FR 1436154 A	01-07-1966	GB 1082575 A	
JP 11144751 A		NONE	
US 2925454 A	16-02-1960	BE 545125 A CH 34166 A DE 1071175 B FR 1148012 A GB 821688 A LU 34166 A NL 110406 C NL 204239 A	03-12-1957
US 3227585 A	04-01-1966	NONE	

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

DE KOCK, E.  
RUSSELL REYNEKE  
Suite 700 - Two Bentall Centre  
555 Burrard Street  
Vancouver, British Columbia V7X 1M8  
CANADA

PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT  
(PCT Rule 71.1)

Date of mailing  
(day/month/year)

17.03.00

Applicant's or agent's file reference  
142201 (BAL)

IMPORTANT NOTIFICATION

International application No.  
PCT/CA99/00134

International filing date (day/month/year)  
24/02/1999

Priority date (day/month/year)  
25/02/1998

Applicant  
BALLARD POWER SYSTEMS INC. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>142201 (BAL)</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/CA99/00134</b>	International filing date (day/month/year) <b>24/02/1999</b>	Priority date (day/month/year) <b>25/02/1998</b>
International Patent Classification (IPC) or national classification and IPC <b>H01M8/10</b>		
Applicant <b>BALLARD POWER SYSTEMS INC. et al.</b>		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand <b>24/09/1999</b>	Date of completion of this report <b>17. 03. 00</b>
Name and mailing address of the international preliminary examining authority:  <b>European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465</b>	Authorized officer <b>Hammerstein, G</b> Telephone No. +49 89 2399 8175 

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/CA99/00134

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1-23	as originally filed	
24	with telefax of	22/02/2000

**Claims, No.:**

9-16,17 (part), 24-34	as originally filed	
1-8,17 (part), 18-23	with telefax of	22/02/2000

**Drawings, sheets:**

1/10-10/10	as originally filed
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2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/CA99/00134

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims 1-34
	No: Claims
Inventive step (IS)	Yes: Claims 1-34
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-34
	No: Claims

**2. Citations and explanations**

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/CA99/00134

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The present application validly claims the priorities of DE 19807876.5 (25.02.1998) and US 09/191049 (12.11.1998). Thus, the "P"-documents cited in the search report do not form prior art under Article 33 PCT.

FR-A-1436154 discloses DME among a variety of organic substances which are suggested as fuel for fuel cells consisting of an anode and a cathode prepared from an active metal powder and teflon, the electrolyte being phosphoric acid.

Q. Zao et al. in "Electrocatalytic Oxidation of Methanol and Dimethyl Ether on Platinum at Elevated Temperatures in 85 %  $\text{H}_3\text{PO}_4$ ", Extended Abstracts of the Spring Meeting (1994), concludes from measurements in phosphoric acid that DME can be electrooxidized like methanol under similar experimental conditions.

The feature distinguishing independent claims 1 and 22 of the present application over these documents is the use of a solid polymer electrolyte fuel cell. None of the available documents suggests this feature.

Claims 1-34 therefore meet the requirements of Article 33(1) PCT for novelty and inventivity.



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What is claimed is:

- 5 1. A method of operating a fuel cell, said fuel cell comprising a cathode, an anode, and a solid polymer electrolyte, said method comprising supplying a fuel stream comprising dimethyl ether to said anode wherein dimethyl ether is directly oxidized at said anode.
- 10 2. The method of Claim 1 wherein the operating temperature of said fuel is less than about 200°C.
- 15 3. The method of Claim 2 wherein said fuel cell is a solid polymer fuel cell and said electrolyte comprises a proton exchange membrane.
- 20 4. The method of Claim 3 wherein said fuel stream is a liquid.
5. The method of Claim 4 wherein said liquid fuel stream additionally comprises water.
- 25 6. The method of Claim 5 wherein said liquid fuel stream comprises greater than about 1.5 moles of dimethyl ether per litre of water.
- 30 7. The method of Claim 5 wherein said liquid fuel stream comprises an additional fuel.
8. The method of Claim 7 wherein said additional fuel is methanol.

AMENDED SHEET

- 27 -

pressure swing absorption, water absorption, or membrane separation.

5 18. The method of Claim 16 wherein the recirculating comprises separating unreacted dimethyl ether from the cathode exhaust by pressure swing absorption, water absorption, or membrane separation.

10 19. The method of Claim 1 comprising introducing dimethyl ether into said cathode before shutdown whereby freezing of the cathode during shutdown is prevented.

15 20. The method of Claim 1 comprising varying the composition of said fuel stream supplied to said anode during the operating of said fuel cell.

20 21. The method of Claim 20 wherein the composition varies in accordance with a fuel cell operating parameter.

25 22. A fuel cell system comprising a fuel cell and a fuel stream supply comprising dimethyl ether, said fuel cell comprising a cathode, an anode, and a solid polymer electrolyte, wherein said anode is fluidly connected to directly oxidize dimethyl ether in said fuel stream supply comprising dimethyl ether.

30 23. The fuel cell system of Claim 22 wherein said fuel cell is a solid polymer fuel cell and said electrolyte comprises a proton exchange membrane.

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AMENDED SHEET

## PATENT COOPERATION TREATY

DOCKETED

February 24, 2000

PCT

WRITTEN OPINION

(PCT Rule 66)

From the:  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:  
DE KOCK, E.  
RUSSELL REYNEKE  
Suite 700 - Two Bentall Centre  
555 Burrard Street  
Vancouver, British Columbia V7X 1M8  
CANADA

Date of mailing  
(day/month/year)

24. 11. 99

Applicant's or agent's file reference  
142201 (BAL)

REPLY DUE

within 3 month(s)  
from the above date of mailing

International application No.  
PCT/CA99/00134

International filing date (day/month/year)  
24/02/1999

Priority date (day/month/year)  
25/02/1998

International Patent Classification (IPC) or both national classification and IPC  
H01M8/10

Applicant  
BALLARD POWER SYSTEMS INC. et al.

1. This written opinion is the first drawn up by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
  - I ☒ Basis of the opinion
  - II ☐ Priority
  - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
  - IV ☐ Lack of unity of invention
  - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - VI ☐ Certain document cited
  - VII ☐ Certain defects in the international application
  - VIII ☒ Certain observations on the international application
3. The applicant is hereby invited to reply to this opinion.


**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also:** For an additional opportunity to submit amendments, see Rule 66.4.  
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.  
For an informal communication with the examiner, see Rule 66.6.

**If no reply is filed,** the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 25/06/2000.

Name and mailing address of the international preliminary examining authority:

 European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized officer / Examiner

Hammerstein, G

Formalities officer (incl. extension of time limits)  
Hartmann, M  
Telephone No. +49 89 2399 8039





**I. Basis of the opinion**

1. This opinion has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed")*.

**Description, pages:**

1-24 as originally filed

**Claims, No.:**

1-34 as originally filed

**Drawings, sheets:**

1/10-10/10 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Claims 1-5,22-34: no
Inventive step (IS)	Claims 6-21: no
Industrial applicability (IA)	Claims

**2. Citations and explanations**

**s e s parat sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re Item V**

**Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Neither of the priority documents DE 19807876.5 (25.02.1998) and US 09/191049 (12.11.1998) do explicitly disclose the combination of a polymer electrolyte fuel cell and direct oxidation of dimethyl ether at the anode.

Thus, the claimed priority dates are not valid and the "P" documents form prior art under Article 33 PCT.

2. Reference is made to the following documents:

D1: T. Yasuyuki et al. "Feasibility of fuel cell using dimethyl ether fuel",  
see in particular Chemical abstracts, abstract no. 327226,

D2: FR-A-1436154,  
see in particular page 5, left column line 43 to page 7, right column, line 5,

D3: WO-A-9612317,  
see in particular the claims.

3. D1 teaches a PEMFC as direct DME fuel cell.  
The subject-matter of claims 1-5 and 22-25 is therefore not new in view of D1.

D2 discloses DME among a variety of organic substances which are suggested as fuel for fuel cells. The fuel cells consist of an anode and a cathode prepared from an active metal powder and teflon, the electrolyte is phosphoric acid.  
The subject-matter of claims 1 and 2 is therefore anticipated by D2.

The applicant's attention is drawn to the fact (see section VIII below), that the features relating to the type of fuel and its supply to the fuel cell are features of a method of operating a fuel cell. They cannot characterize the fuel cell itself, unless these features render the fuel cell per se different from e.g. a direct methanol fuel

cell. As is evident from pages 14, 2nd and 3rd paragraph, where reference is made to the use of conventional fuel cells, this is, however, not the case. Moreover, reference is made to the document D3 which discloses a fuel cell as is defined in claims 22-34.

The subject-matter of claims 22-34 therefore lacks novelty over conventional direct methanol fuel cells.

As set out on page 6, lines 6-12, DME has already been used in SOFC with internal reforming.

Claims 1 and 22 which do not define a PEMFC therefore lack novelty in view of this prior art.

It follows from the above that claims 1-5 and 22-34 do not fulfill the requirements of Article 33(2) PCT.

4. With regard to inventivity the document D1 is regarded as closest prior art. It anticipates the idea underlying the present application, namely the direct oxidation of DME at the anode of a polymer electrolyte fuel cell. The additional features forming the subject-matter of the dependent claims not mentioned under point 3 above are details of the fuel supply and cell which a person skilled in the art could find out by routine tests on the basis of D1.

Claims 6-21 do therefore not meet the requirements of Article 33(3) PCT.

#### **Re Item VIII**

##### **Certain observations on the international application**

1. Claims 22-34 are directed towards a system contain features both of an apparatus (= a fuel cell) and of a method (= the type of fuel to be oxidized). The category of the claims and hence the scope of protection sought is unclear, Article 6 PCT. In this context it is pointed out that the use of a fuel cell with a particular fuel is not a feature of the fuel cell, but of a method for the operation of the fuel cell. Thus, for the purposes of section V above only the features characterizing the apparatus per se are considered and those relating to the type of fuel are

**WRITTEN OPINION  
SEPARATE SHEET**

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International application No. PCT/CA99/00134

disregarded, unless the type of fuel or its supply put a restriction on the cell itself.

2. The vague and imprecise statement in the description on page 24 implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them (see also the PCT Guidelines, PCT/GL/3 III, 4.3a).

It is not at present apparent which part of the application could serve as a basis for a new and inventive claim. Should the applicant nevertheless regard some particular matter as new and inventive, an independent claim including such matter.

The applicant should also indicate in the letter of reply the difference of the subject-matter of the new claim vis-à-vis the state of the art and the significance thereof. When filing amended claims the applicant should at the same time bring the description into conformity with the amended claims. Care should be taken during revision, especially of the introductory portion and any statements of problem or advantage, not to add subject-matter which extends beyond the content of the application as originally filed (Article 19(2) PCT). In order to facilitate the examination of the conformity of the amended application with the requirements of Article 19(2) PCT, the applicant is requested to clearly identify the amendments carried out, irrespective of whether they concern amendments by addition, replacement or deletion, and to indicate the passages of the application as filed on which these amendments are based.